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fx-83GT PLUS
fx-85GT PLUS

User's Guide

CASIO Worldwide Education Website

http://edu.casio.com

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CASIO®

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Important Information

- The displays and illustrations (such as key markings) shown in this User's Guide are for illustrative purposes only, and may differ somewhat from the actual items they represent.
- The contents of this manual are subject to change without notice.
- In no event shall CASIO Computer Co., Ltd. be liable to anyone for special, collateral, incidental, or consequential damages in connection with or arising out of the purchase or use of this product and items that come with it. Moreover, CASIO Computer Co., Ltd. shall not be liable for any claim of any kind whatsoever by any other party arising out of the use of this product and the items that come with it.
- Be sure to keep all user documentation handy for future reference.

Sample Operations

Sample operations in this manual are indicated by a ✎ icon. Unless specifically stated, all sample operations assume that the calculator is in its initial default setup. Use the procedure under "Initializing the Calculator" to return the calculator to its initial default setup.

For information about the MATH, LINE, Deg, and Rad marks that are shown in the sample operations, see "Configuring the Calculator Setup".

Initializing the Calculator

Perform the following procedure when you want to initialize the calculator and return the calculation mode and setup to their initial default settings. Note that this operation also clears all data currently in calculator memory.

SHIFT 9 (CLR) 3 (All) = (Yes)

Safety Precautions

⚠ **Battery**

- Keep batteries out of the reach of small children.
- Use only the type of battery specified for this calculator in this manual.

Handling Precautions

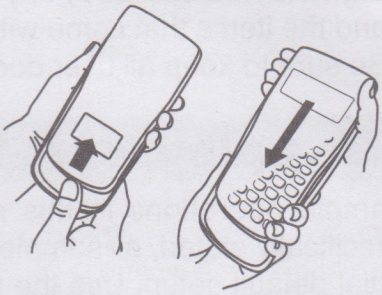
- **Even if the calculator is operating normally, replace the battery at least once every two years (R03 (UM-4)), or three years (LR44 (GPA76)).**
  A dead battery can leak, causing damage to and malfunction of the calculator. Never leave a dead battery in the calculator. Do not try using the calculator while the battery is completely dead (fx-85GT PLUS).
- **The battery that comes with the calculator discharges slightly during shipment and storage. Because of this, it may require replacement sooner than the normal expected battery life.**
- **Do not use an oxyride battery* or any other type of nickel-based primary battery with this product. Incompatibility between such batteries and product specifications can result in shorter battery life and product malfunction.**
- **Avoid use and storage of the calculator in areas subjected to temperature extremes, and large amounts of humidity and dust.**

- **Do not subject the calculator to excessive impact, pressure, or bending.**
- **Never try to take the calculator apart.**
- **Use a soft, dry cloth to clean the exterior of the calculator.**
- **Whenever discarding the calculator or batteries, be sure to do so in accordance with the laws and regulations in your particular area.**

* Company and product names used in this manual may be registered trademarks or trademarks of their respective owners.

Removing the Hard Case

Before using the calculator, slide its hard case downwards to remove it, and then affix the hard case to the back of the calculator as shown in the illustration nearby.



Turning Power On and Off

Press [ON] to turn on the calculator.
Press [SHIFT] [AC] (OFF) to turn off the calculator.

Auto Power Off

Your calculator will turn off automatically if you do not perform any operation for about 10 minutes. If this happens, press the [ON] key to turn the calculator back on.

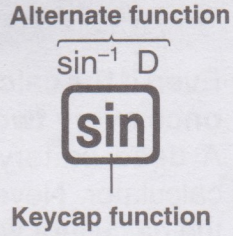
Adjusting Display Contrast

Display the CONTRAST screen by performing the following key operation: [SHIFT] [MODE] (SETUP) ▼ [6] (◄CONT►). Next, use ◄ and ► to adjust contrast. After the setting is the way you want, press [AC].

Important: If adjusting display contrast does not improve display readability, it probably means that battery power is low. Replace the battery.

Key Markings

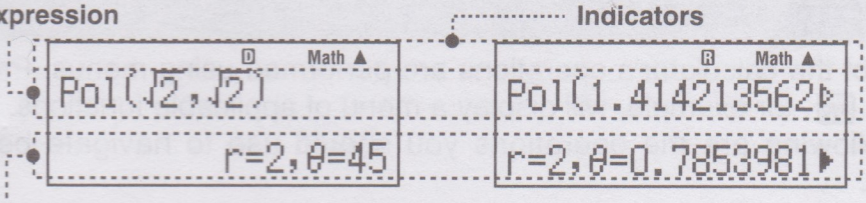
Pressing the [SHIFT] or [ALPHA] key followed by a second key performs the alternate function of the second key. The alternate function is indicated by the text printed above the key.
The following shows what the different colors of the alternate function key text mean.



If key marking text is this color:	It means this:
Yellow	Press [SHIFT] and then the key to access the applicable function.
Red	Press [ALPHA] and then the key to input the applicable variable, constant, or symbol.

Reading the Display

The display of the calculator shows expressions you input, calculation results, and various indicators.



- If a ▶ indicator appears on the right side of the calculation result, it means the displayed calculation result continues to the right. Use ▶ and ◀ to scroll the calculation result display.
- If a ▷ indicator appears on the right side of the input expression, it means the displayed calculation continues to the right. Use ▶ and ◀ to scroll the input expression display. Note that if you want to scroll the input expression while both the ▶ and ▷ indicators are displayed, you will need to press [AC] first and then use ▶ and ◀ to scroll.

Display indicators

This indicator:	Means this:
S	The keypad has been shifted by pressing the [SHIFT] key. The keypad will unshift and this indicator will disappear when you press a key.
A	The alpha input mode has been entered by pressing the [ALPHA] key. The alpha input mode will be exited and this indicator will disappear when you press a key.
M	There is a value stored in independent memory.
STO	The calculator is standing by for input of a variable name to assign a value to the variable. This indicator appears after you press [SHIFT] [RCL] (STO).
RCL	The calculator is standing by for input of a variable name to recall the variable's value. This indicator appears after you press [RCL].
STAT	The calculator is in the STAT Mode.
D	The default angle unit is degrees.
R	The default angle unit is radians.
G	The default angle unit is grads.
FIX	A fixed number of decimal places is in effect.
SCI	A fixed number of significant digits is in effect.
Math	Natural Display is selected as the display format.
▼▲	Calculation history memory data is available and can be replayed, or there is more data above/below the current screen.
Disp	The display currently shows an intermediate result of a multi-statement calculation.

Important: For some type of calculation that takes a long time to execute, the display may show only the above indicators (without any value) while it performs the calculation internally.

Using Menus

Some of the calculator's operations are performed using menus. Pressing [MODE] or [hyp], for example, will display a menu of applicable functions.
The following are the operations you should use to navigate between menus.

- You can select a menu item by pressing the number key that corresponds to the number to its left on the menu screen.
- The ▼ indicator in the upper right corner of a menu means there is another menu below the current one. The ▲ indicator means another menu above. Use ▼ and ▲ to switch between menus.
- To close a menu without selecting anything, press [AC].

Specifying the Calculation Mode

When you want to perform this type of operation:	Perform this key operation:
General calculations	[MODE] [1] (COMP)
Statistical and regression calculations	[MODE] [2] (STAT)
Generation of a number table based on an expression	[MODE] [3] (TABLE)
Verify a calculation	[MODE] [4] (VERIF)

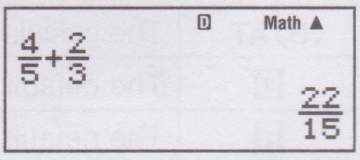
Note: The initial default calculation mode is the COMP Mode.

Configuring the Calculator Setup

First perform the following key operation to display the setup menu: [SHIFT] [MODE] (SETUP). Next, use ▼ and ▲ and the number keys to configure the settings you want.
Underlined (___) settings are initial defaults.

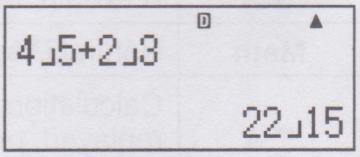
[1] MthIO [2] LineIO Specifies the display format.

Natural Display (MthIO) causes fractions, irrational numbers, and other expressions to be displayed as they are written on paper.



MthIO: Selects MathO or LineO. MathO displays input and calculation results using the same format as they are written on paper. LineO displays input the same way as MathO, but calculation results are displayed in linear format.

Linear Display (LineIO) causes fractions and other expressions to be displayed in a single line.



Note: • The calculator switches to Linear Display automatically whenever you enter the STAT Mode. • In this manual, the MATH symbol next to a sample operation indicates Natural Display (MathO), while the LINE symbol indicates Linear Display.

[3] **Deg** [4] **Rad** [5] **Gra** Specifies degrees, radians or grads as the angle unit for value input and calculation result display.

Note: In this manual, the **Deg** symbol next to a sample operation indicates degrees, while the **Rad** symbol indicates radians.

[6] **Fix** [7] **Sci** [8] **Norm** Specifies the number of digits for display of a calculation result.

Fix: The value you specify (from 0 to 9) controls the number of decimal places for displayed calculation results. Calculation results are rounded off to the specified digit before being displayed.

Example: **LINE** $100 \div 7 = 14.286$ (Fix 3)
14.29 (Fix 2)

Sci: The value you specify (from 1 to 10) controls the number of significant digits for displayed calculation results. Calculation results are rounded off to the specified digit before being displayed.

Example: **LINE** $1 \div 7 = 1.4286 \times 10^{-1}$ (Sci 5)
1.429×10^{-1} (Sci 4)

Norm: Selecting one of the two available settings (**Norm 1**, Norm 2) determines the range in which results will be displayed in non-exponential format. Outside the specified range, results are displayed using exponential format.

Norm 1: $10^{-2} > |x|, |x| \geqq 10^{10}$ Norm 2: $10^{-9} > |x|, |x| \geqq 10^{10}$

Example: **LINE** $1 \div 200 = 5 \times 10^{-3}$ (Norm 1)
0.005 (Norm 2)

▼ [1] **ab/c** ▼ [2] **d/c** Specifies either mixed fraction (ab/c) or improper fraction (d/c) for display of fractions in calculation results.

▼ [3] **STAT** [1] **ON** ; [2] **OFF** Specifies whether or not to display a FREQ (frequency) column in the STAT Mode Stat Editor.

▼ [4] **Rdec** [1] **ON** ; [2] **OFF** Specifies whether or not to display calculation results using recurring decimal form.

▼ [5] **Disp** [1] **Dot** ; [2] **Comma** Specifies whether to display a dot or a comma for the calculation result decimal point. A dot is always displayed during input.

Note: When dot is selected as the decimal point, the separator for multiple results is a comma (,). When comma is selected, the separator is a semicolon (;).

▼ [6] ◄CONT► Adjusts display contrast. See "Adjusting Display Contrast" for details.

Initializing Calculator Settings

Perform the following procedure to initialize the calculator, which returns the calculation mode to COMP and returns all other settings, including setup menu settings, to their initial defaults.

SHIFT [9] (CLR) [1] (Setup) [=] (Yes)

Inputting Expressions and Values

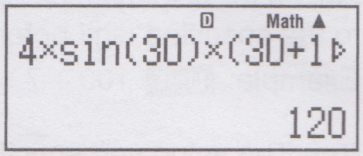
Basic Input Rules

Calculations can be input in the same form as they are written. When you press [=] the priority sequence of the input calculation will be evaluated automatically and the result will appear on the display.

$4 \times \sin 30 \times (30 + 10 \times 3) = 120$

[4] [×] [sin] 30 [)] [×] [(] 30 [+] 10 [×] 3 [)] [=]

*1 *2 *3



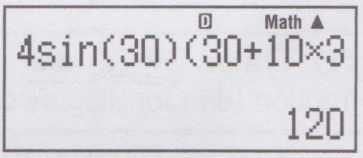
*1 Input of the closing parenthesis is required for sin, sinh, and other functions that include parentheses.

*2 These multiplication symbols (×) can be omitted. A multiplication symbol can be omitted when it occurs immediately before an opening parenthesis, immediately before sin or other function that includes parentheses, immediately before the Ran# (random number) function, or immediately before a variable (A, B, C, D, E, F, M, X, Y), π or e.

*3 The closing parenthesis immediately before the [=] operation can be omitted.

Input example omitting [×]*2 and [)]*3 operations in the above example.

[4] [sin] 30 [)] [(] 30 [+] 10 [×] 3 [=]



Note: • If the calculation becomes longer than the screen width during input, the screen will scroll automatically to the right and the ◄ indicator will appear on the display. When this happens, you can scroll back to the left by using [◄] and [►] to move the cursor. • When Linear Display is selected, pressing [▲] will cause the cursor to jump to the beginning of the calculation, while [▼] will jump to the end. • When Natural Display is selected, pressing [►] while the cursor is at the end of the input calculation will cause it to jump to the beginning, while pressing [◄] while the cursor is at the beginning will cause it to jump to the end. • You can input up to 99 bytes for a calculation. Each numeral, symbol, or function normally uses one byte. Some functions require three to 13 bytes. • The cursor will change shape to ■ when there are 10 bytes or less of allowed input remaining. If this happens, end calculation input and then press [=].

Calculation Priority Sequence

The priority sequence of input calculations is evaluated in accordance with the rules below. When the priority of two expressions is the same, the calculation is performed from left to right.

1st	Parenthetical expressions
2nd	Functions that require an argument to the right and a closing parenthesis ")" following the argument.
3rd	Functions that come after the input value (x^2, x^3, x^{-1}, $x!$, °' ", °, ^{r}, ^{g}, %), powers ($x^{\blacksquare}$), roots ($\sqrt[\blacksquare]{\square}$)
4th	Fractions

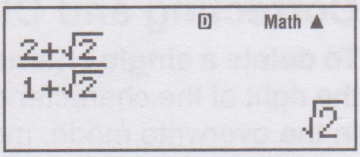
5th	Negative sign (–) **Note:** When squaring a negative value (such as –2), the value being squared must be enclosed in parentheses ([(] [(–)] 2 [)] [x^2] [=]). Since x^2 has a higher priority than the negative sign, inputting [(–)] 2 [x^2] [=] would result in the squaring of 2 and then appending a negative sign to the result. Always keep the priority sequence in mind, and enclose negative values in parentheses when required.
6th	STAT Mode estimated values ($\hat{x}$, $\hat{y}$, $\hat{x}_1$, $\hat{x}_2$)
7th	Multiplication where the multiplication sign is omitted
8th	Permutation (nPr), combination (nCr)
9th	Multiplication, division (×, ÷)
10th	Addition, subtraction (+, –)

Inputting with Natural Display

Selecting Natural Display makes it possible to input and display fractions and certain functions (log, x^2, x^3, $x^{\blacksquare}$, $\sqrt{\blacksquare}$, $\sqrt[3]{\blacksquare}$, $\sqrt[\blacksquare]{\square}$, x^{-1}, $10^{\blacksquare}$, $e^{\blacksquare}$, Abs) just as they are written in your textbook.

$\frac{2+\sqrt{2}}{1+\sqrt{2}}$ MATH

[▤] 2 [+] [√] 2 [▶] [▶] 1 [+] [√] 2 [=]



Important: • Certain types of expressions can cause the height of a calculation formula to be greater than one display line. The maximum allowable height of a calculation formula is two display screens (31 dots × 2). Further input will become impossible if the height of the calculation you are inputting exceeds the allowable limit. • Nesting of functions and parentheses is allowed. Further input will become impossible if you nest too many functions and/or parentheses. If this happens, divide the calculation into multiple parts and calculate each part separately.

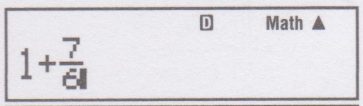
Note: When you press [=] and obtain a calculation result using Natural Display, part of the expression you input may be cut off. If you need to view the entire input expression again, press [AC] and then use [◀] and [▶] to scroll the input expression.

Using Values and Expressions as Arguments (Natural Display only)

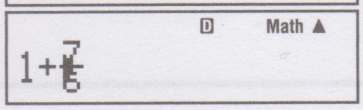
A value or an expression that you have already input can be used as the argument of a function. After you have input $\frac{7}{6}$, for example, you can make it the argument of $\sqrt{\ }$, resulting in $\sqrt{\frac{7}{6}}$.

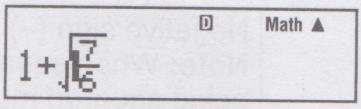
To input $1+\frac{7}{6}$ and then change it to $1+\sqrt{\frac{7}{6}}$ MATH

1 [+] 7 [▤] 6



[◀] [◀] [◀] [◀] [SHIFT] [DEL](INS)



[√■] 

As shown above, the value or expression to the right of the cursor after [SHIFT] [DEL](INS) are pressed becomes the argument of the function that is specified next. The range encompassed as the argument is everything up to the first open parenthesis to the right, if there is one, or everything up to the first function to the right (sin(30), log2(4), etc.)
This capability can be used with the following functions: [▤], [log▪□], [SHIFT] [x▪](▪√□), [SHIFT] [log](10▪), [SHIFT] [ln](e▪), [√■], [x▪], [SHIFT] [√■](³√■), [Abs].

Overwrite Input Mode (Linear Display only)

You can select either insert or overwrite as the input mode, but only while Linear Display is selected. In the overwrite mode, text you input replaces the text at the current cursor location. You can toggle between the insert and overwrite modes by performing the operations: [SHIFT] [DEL](INS). The cursor appears as "▮" in the insert mode and as "▁" in the overwrite mode.

Note: Natural Display always uses the insert mode, so changing display format from Linear Display to Natural Display will automatically switch to the insert mode.

Correcting and Clearing an Expression

To delete a single character or function: Move the cursor so it is directly to the right of the character or function you want to delete, and then press [DEL]. In the overwrite mode, move the cursor so it is directly under the character or function you want to delete, and then press [DEL].
To insert a character or function into a calculation: Use [◀] and [▶] to move the cursor to the location where you want to insert the character or function and then input it. Be sure always to use the insert mode if Linear Display is selected.
To clear all of the calculation you are inputting: Press [AC].

Recurring Decimal Calculations

Your calculator uses a recurring decimal when you input a value. Calculation results also can be displayed using recurring decimal form whenever applicable.

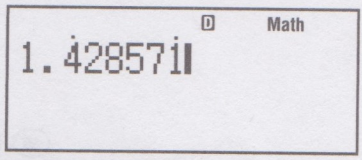
Inputting a Recurring Decimal

When inputting a recurrent decimal, press [SHIFT] [x²](▪̇) before inputting its period (repetend) and then input the period up to the ending value. To input the recurring decimal 0.909090.... (0.$\dot{9}\dot{0}$), perform the following operation: "0 [•] [SHIFT] [x²](▪̇) 90".

Important: • If the value starts with an integer part (like: 12.3123123...), do not include the integer part when inputting the period (12.3$\dot{1}\dot{2}$). • Recurring decimal input is possible only when Natural Display is selected.

To input 1.428571428571... (1.$\dot{4}28571\dot{1}$) **MATH**

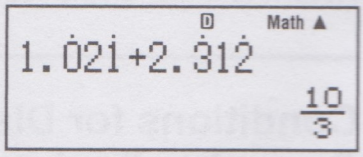
1 [•] [SHIFT] [x²](▪̇)
428571



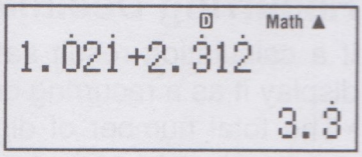
B

To calculate $1.\dot{0}2\dot{1} + 2.3\dot{1}\dot{2}$ **MATH**

1 . SHIFT x^2 (■) 021 ▶ +
2 . SHIFT x^2 (■) 312 =



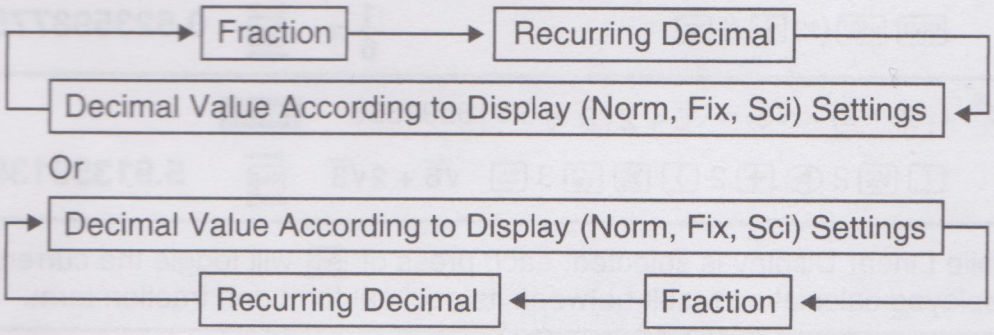
Calculation result displayed as recurring decimal value: S⇔D



Note: • You can specify up to 14 decimal places for the recurring decimal period. If you input more than 14 decimal places, the value will be treated as a terminating decimal and not a recurring decimal. • Recurring decimal value input can be performed regardless of the Rdec setting on the setup menu.

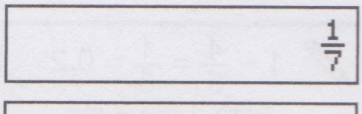
Displaying a Calculation Result as a Recurring Decimal Value

Calculation results that can be displayed as recurring decimal values will be displayed as such when ON is selected for the Rdec setting on the setup menu. Pressing the S⇔D key will cycle between the available calculation result formats as shown below.

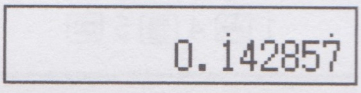


$\frac{1}{7} = 0.\dot{1}42857\dot{} = 0.1428571429$ (Norm 1) **MATH**

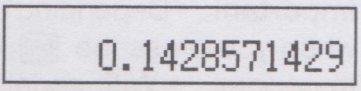
1 ÷ 7 =



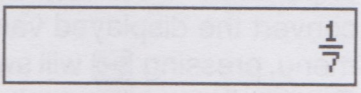
Display as recurring decimal: S⇔D



Decimal value according to Norm 1 setting: S⇔D

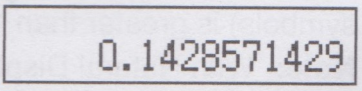


Return to initial display format (fraction): S⇔D

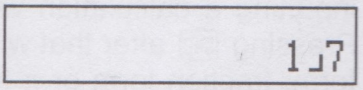


$1 \div 7 = 0.1428571429$ (Norm 1) $= 0.\dot{1}42857\dot{} = \frac{1}{7}$ **LINE**

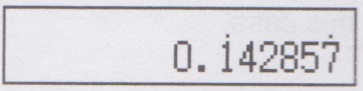
1 ÷ 7 =



Display as fraction: S⇔D



Display as recurring decimal: S⇔D



B

Return to initial display format (Norm 1): [S⇔D] 0.1428571429

Conditions for Displaying a Calculation Result as a Recurring Decimal

If a calculation result satisfies the following conditions, pressing [S⇔D] will display it as a recurring decimal value.

- The total number of digits used in the mixed fraction (including integer, numerator, denominator, and separator symbol) must be no more than 10.

Note: For information about switching the display format of a calculation result when OFF is selected for the Rdec setting on the setup menu, see "Toggling Calculation Results".

Toggling Calculation Results

While Natural Display is selected, each press of [S⇔D] will toggle the currently displayed calculation result between its fraction form and decimal form, its $\sqrt{\ }$ form and decimal form, or its π form and decimal form.

$\pi \div 6 = \frac{1}{6}\pi = 0.5235987756$ MATH

[SHIFT] [×10^x] (π) [÷] 6 [=] $\frac{1}{6}\pi$ [S⇔D] **0.5235987756**

$(\sqrt{2} + 2) \times \sqrt{3} = \sqrt{6} + 2\sqrt{3} = 5.913591358$ MATH

[(] [√] 2 [▶] [+] 2 [)] [×] [√] 3 [=] $\sqrt{6} + 2\sqrt{3}$ [S⇔D] **5.913591358**

While Linear Display is selected, each press of [S⇔D] will toggle the currently displayed calculation result between its decimal form and fraction form.

$1 \div 5 = 0.2 = \frac{1}{5}$ LINE

1 [÷] 5 [=] **0.2** [S⇔D] **1⌟5**

$1 - \frac{4}{5} = \frac{1}{5} = 0.2$ LINE

1 [−] 4 [▼] 5 [=] **1⌟5** [S⇔D] **0.2**

Important: • Depending on the type of calculation result that is on the display when you press the [S⇔D] key, the conversion process may take some time to perform. • With certain calculation results, pressing the [S⇔D] key will not convert the displayed value. • When ON is selected for Rdec on the setup menu, pressing [S⇔D] will switch the calculation result to recurring decimal form. For details, see "Recurring Decimal Calculations". • You cannot switch from decimal form to mixed fraction form if the total number of digits used in the mixed fraction (including integer, numerator, denominator, and separator symbols) is greater than 10.

Note: With Natural Display (MathO), pressing [SHIFT] [=] instead of [=] after inputting a calculation will display the calculation result in decimal form. Pressing [S⇔D] after that will switch the calculation result to recurring decimal form, fraction form or π form. The $\sqrt{\ }$ form of the result will not appear in this case.

Basic Calculations

Fraction Calculations

Note that the input method for fractions is different, depending upon whether you are using Natural Display or Linear Display.

$\frac{2}{3} + \frac{1}{2} = \frac{7}{6}$ **MATH** 2 ▤ 3 ▶ + 1 ▤ 2 = $\frac{7}{6}$

or ▤ 2 ▼ 3 ▶ + ▤ 1 ▼ 2 = $\frac{7}{6}$

LINE 2 ▤ 3 + 1 ▤ 2 = **7⌟6**

$4 - 3\frac{1}{2} = \frac{1}{2}$ **MATH** 4 − SHIFT ▤ (▬▤) 3 ▶ 1 ▼ 2 = $\frac{1}{2}$

LINE 4 − 3 ▤ 1 ▤ 2 = **1⌟2**

Note: • Mixing fractions and decimal values in a calculation while Linear Display is selected will cause the result to be displayed as a decimal value. • Fractions in calculation results are displayed after being reduced to their lowest terms.

To switch a calculation result between improper fraction and mixed fraction form: Perform the following key operation: SHIFT S⇔D ($a\frac{b}{c} \leftrightarrow \frac{d}{c}$)

To switch a calculation result between fraction and decimal form: Press S⇔D.

Percent Calculations

Inputting a value and pressing SHIFT ((%) causes the input value to become a percent.

$150 \times 20\% = 30$ 150 × 20 SHIFT ((%) = **30**

Calculate what percentage of 880 is 660. (75%)

660 ÷ 880 SHIFT ((%) = **75**

Increase 2500 by 15%. (2875)

2500 + 2500 × 15 SHIFT ((%) = **2875**

Discount 3500 by 25%. (2625)

3500 − 3500 × 25 SHIFT ((%) = **2625**

Degree, Minute, Second (Sexagesimal) Calculations

Performing an addition or subtraction operation between sexagesimal values, or a multiplication or division operation between a sexagesimal value and a decimal value will cause the result to be displayed as a sexagesimal value. You also can convert between sexagesimal and decimal. The following is the input format for a sexagesimal value: {degrees} °‘‘‘ {minutes} °‘‘‘ {seconds} °‘‘‘.

Note: You must always input something for the degrees and minutes, even if they are zero.

$2°20'30'' + 39'30'' = 3°00'00''$

2 °‘‘‘ 20 °‘‘‘ 30 °‘‘‘ + 0 °‘‘‘ 39 °‘‘‘ 30 °‘‘‘ = **3°0'0''**

Convert 2°15′18″ to its decimal equivalent.

2 °’” 15 °’” 18 °’” =		2°15′18″
(Converts sexagesimal to decimal.)	°’”	2.255
(Converts decimal to sexagesimal.)	°’”	2°15′18″

Multi-Statements

You can use the colon character (:) to connect two or more expressions and execute them in sequence from left to right when you press =.

3 + 3 : 3 × 3	3 + 3 ALPHA x^3 (:) 3 × 3 =		6
	=		9

Using Engineering Notation

A simple key operation transforms a displayed value to engineering notation.

Transform the value 1234 to engineering notation, shifting the decimal point to the right.

1234 =		1234
ENG		1.234×10^{3}
ENG		1234×10^{0}

Transform the value 123 to engineering notation, shifting the decimal point to the left.

123 =		123
SHIFT ENG (←)		0.123×10^{3}
SHIFT ENG (←)		0.000123×10^{6}

Calculation History

In the COMP Mode, you can scroll through calculation history contents using ▲ and ▼.

1 + 1 = 2	1 + 1 =		2
2 + 2 = 4	2 + 2 =		4
3 + 3 = 6	3 + 3 =		6
	(Scrolls back.)	▲	4
	(Scrolls back again.)	▲	2

Note: Calculation history data is all cleared whenever you press ON, when you change to a different calculation mode, when you change the display format, or whenever you perform any reset operation.

Replay

While a calculation result is on the display, you can press ◀ or ▶ to edit the expression you used for the previous calculation.

4 × 3 + 2.5 = 14.5	LINE	4 × 3 + 2.5 =	14.5
4 × 3 – 7.1 = 4.9	(Continuing) ◀ DEL DEL DEL DEL	– 7.1 =	4.9

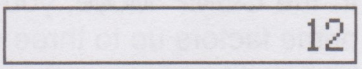
Note: If you want to edit a calculation when the ▶ indicator is on the right side of a calculation result display (see "Reading the Display"), press [AC] and then use [◀] and [▶] to scroll the calculation.

Answer Memory (Ans)

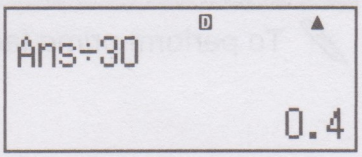
The last calculation result obtained is stored in Ans (answer) memory. Ans memory contents are updated whenever a new calculation result is displayed.

To divide the result of 3 × 4 by 30 **LINE**

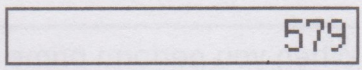
3 [×] 4 [=]



(Continuing) [÷] 30 [=]

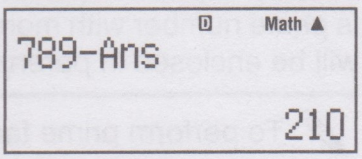


123 + 456 = 579 **MATH** 123 [+] 456 [=]



789 − 579 = 210

(Continuing) 789 [−] [Ans] [=]



Variables (A, B, C, D, E, F, X, Y)

Your calculator has eight preset variables named A, B, C, D, E, F, X, and Y. You can assign values to variables and also use the variables in calculations.

To assign the result of 3 + 5 to variable A

3 [+] 5 [SHIFT] [RCL] (STO) [(−)] (A) **8**

To multiply the contents of variable A by 10

(Continuing) [ALPHA] [(−)] (A) [×] 10 [=] **80**

To recall the contents of variable A (Continuing) [RCL] [(−)] (A) **8**

To clear the contents of variable A 0 [SHIFT] [RCL] (STO) [(−)] (A) **0**

Independent Memory (M)

You can add calculation results to or subtract results from independent memory. The "M" appears on the display when there is any value other than zero stored in independent memory.

To clear the contents of M 0 [SHIFT] [RCL] (STO) [M+] (M) **0**

To add the result of 10 × 5 to M (Continuing) 10 [×] 5 [M+] **50**

To subtract the result of 10 + 5 from M

(Continuing) 10 [+] 5 [SHIFT] [M+] (M−) **15**

To recall the contents of M (Continuing) [RCL] [M+] (M) **35**

Note: Variable M is used for independent memory.

Clearing the Contents of All Memories

Ans memory, independent memory, and variable contents are retained even if you press [AC], change the calculation mode, or turn off the calculator. Perform the following procedure when you want to clear the contents of all memories.

[SHIFT] [9] (CLR) [2] (Memory) [=] (Yes)

Prime Factorization

In the COMP Mode, you can factor a positive integer up to 10 digits into prime factors up to three digits.

To perform prime factorization on 1014

1014 [=] → 1014

[SHIFT] [,,,] (FACT) → $2\times3\times13^2$

When you perform prime factorization on a value that includes a factor that is prime number with more than three digits, the part that cannot be factored will be enclosed in parentheses on the display.

To perform prime factorization on 4104676 ($= 2^2 \times 1013^2$)

4104676 [=] [SHIFT] [,,,] (FACT) → $2^2\times(1026169)$

Any one of the following operations will exit prime factorization result display.

- Pressing [SHIFT] [,,,] (FACT) or [=].
- Pressing any of the following keys: [ENG] or [,,,].
- Using the setup menu to change the angle unit setting (Deg, Rad, Gra) or the display digits setting (Fix, Sci, Norm).

Note: • You will not be able to execute prime factorization while a decimal value, fraction, or negative value calculation result is displayed. Trying to do so will cause a math error (Math ERROR). • You will not be able to execute prime factorization while the result of a calculation that uses Pol, Rec is displayed.

Function Calculations

For actual operations using each function, see the "Examples" section following the list below.

π: π is displayed as 3.141592654, but π = 3.14159265358980 is used for internal calculations.

***e*:** *e* is displayed as 2.718281828, but *e* = 2.71828182845904 is used for internal calculations.

sin, cos, tan, $\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$: Trigonometric functions. Specify the angle unit before performing calculations. See ✎1.

sinh, cosh, tanh, $\sinh^{-1}$, $\cosh^{-1}$, $\tanh^{-1}$: Hyperbolic functions. Input a function from the menu that appears when you press [hyp]. The angle unit setting does not affect calculations. See ✎2.

°, ʳ, ᵍ: These functions specify the angle unit. ° specifies degrees, ʳ radians, and ᵍ grads. Input a function from the menu that appears when you perform the following key operation: SHIFT Ans (DRG▶). See 3.

$10^{\blacksquare}$, $e^{\blacksquare}$: Exponential functions. Note that the input method is different depending upon whether you are using Natural Display or Linear Display. See 4.

log: Logarithmic function. Use the log key to input $\log_a b$ as log (a, b). Base 10 is the default setting if you do not input anything for a. The $\log_{\blacksquare}\square$ key also can be used for input, but only while Natural Display is selected. In this case, you must input a value for the base. See 5.

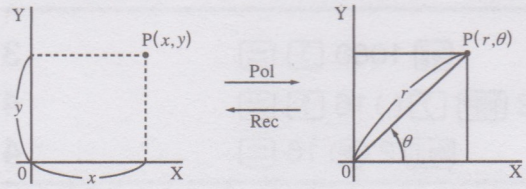
ln: Natural logarithm to base e. See 6.

x^2, x^3, $x^{\blacksquare}$, $\sqrt{\blacksquare}$, $\sqrt[3]{\blacksquare}$, $\sqrt[\blacksquare]{\square}$, x^{-1}: Powers, power roots, and reciprocals. Note that the input methods for $x^{\blacksquare}$, $\sqrt{\blacksquare}$, $\sqrt[3]{\blacksquare}$, and $\sqrt[\blacksquare]{\square}$ are different depending upon whether you are using Natural Display or Linear Display. See 7.

Note: The following functions cannot be input in consecutive sequence: x^2, x^3, $x^{\blacksquare}$, x^{-1}. If you input 2 x^2 x^2, for example, the final x^2 will be ignored. To input 2^{2^2}, input 2 x^2, press the ◀ key, and then press x^2 (MATH).

Pol, Rec: Pol converts rectangular coordinates to polar coordinates, while Rec converts polar coordinates to rectangular coordinates. See 8.

Pol$(x, y) = (r, \theta)$ Rec$(r, \theta) = (x, y)$



Rectangular Coordinates (Rec) **Polar Coordinates (Pol)**

Specify the angle unit before performing calculations.
The calculation result for r and θ and for x and y are each assigned respectively to variables X and Y.
Calculation result θ is displayed in the range of $-180° < \theta \leqq 180°$.

$x!$: Factorial function. See 9.

Abs: Absolute value function. Note that the input method is different depending upon whether you are using Natural Display or Linear Display. See 10.

Ran#: Generates a 3-digit pseudo random number that is less than 1. The result is displayed as a fraction when Natural Display is selected. See 11.

RanInt#: For input of the function of the form RanInt#(a, b), which generates a random integer within the range of a to b. See 12.

***n*Pr, *n*Cr:** Permutation (nPr) and combination (nCr) functions. See 13.

Rnd: The argument of this function is made a decimal value and then rounded in accordance with the current number of display digits setting (Norm, Fix, or Sci). With Norm 1 or Norm 2, the argument is rounded off to 10 digits. With Fix and Sci, the argument is rounded off to the specified digit. When Fix 3 is the display digits setting, for example, the result of 10 ÷ 3 is displayed as 3.333, while the calculator maintains a value of 3.33333333333333 (15 digits) internally for calculation. In the case of Rnd(10÷3) = 3.333 (with Fix 3), both the displayed value and the calculator's internal value become 3.333. Because of this a series of calculations will produce different results depending on whether Rnd is used (Rnd(10÷3) × 3 = 9.999) or not used (10 ÷ 3 × 3 = 10.000). See 14.

Note: Using functions can slow down a calculation, which may delay display of the result. Do not perform any subsequent operation while waiting for the calculation result to appear. To interrupt an ongoing calculation before its result appears, press [AC].

Examples

1 sin 30°= 0.5 — LINE Deg — [sin] 30 [)] [=] — **0.5**

$\sin^{-1}0.5 = 30°$ — LINE Deg — [SHIFT] [sin] ($\sin^{-1}$) 0.5 [)] [=] — **30**

---

2 sinh 1 = 1.175201194 — [hyp] [1] (sinh) 1 [)] [=] — **1.175201194**

$\cosh^{-1} 1 = 0$ — [hyp] [5] ($\cosh^{-1}$) 1 [)] [=] — **0**

---

3 $\pi/2$ radians = 90°, 50 grads = 45° — Deg

[(] [SHIFT] [×10ˣ] (π) [÷] 2 [)] [SHIFT] [Ans] (DRG▶) [2] (ᴿ) [=] — **90**

50 [SHIFT] [Ans] (DRG▶) [3] (ᴳ) [=] — **45**

---

4 To calculate $e^5 \times 2$ to three significant digits (Sci 3)

[SHIFT] [MODE] (SETUP) [7] (Sci) [3]

MATH — [SHIFT] [ln] ($e^{▪}$) 5 [▶] [×] 2 [=] — **2.97×10^{2}**

LINE — [SHIFT] [ln] ($e^{▪}$) 5 [)] [×] 2 [=] — **2.97×10^{2}**

---

5 $\log_{10}1000 = \log 1000 = 3$ — [log] 1000 [)] [=] — **3**

$\log_2 16 = 4$ — [log] 2 [SHIFT] [)] (,) 16 [)] [=] — **4**

MATH — [$\log_{▪}$□] 2 [▶] 16 [=] — **4**

---

6 To calculate ln 90 (= $\log_e$ 90) to three significant digits (Sci 3)

[SHIFT] [MODE] (SETUP) [7] (Sci) [3] — [ln] 90 [)] [=] — **4.50×10^{0}**

---

7 $1.2 \times 10^3 = 1200$ — MATH — 1.2 [×] 10 [$x^{▪}$] 3 [=] — **1200**

$(1+1)^{2+2} = 16$ — MATH [(] 1 [+] 1 [)] [$x^{▪}$] 2 [+] 2 [=] — **16**

$(5^2)^3 = 15625$ — [(] 5 [x^2] [)] [x^3] [=] — **15625**

$\sqrt[5]{32} = 2$ — MATH — [SHIFT] [$x^{▪}$] ($\sqrt[▪]{\square}$) 5 [▶] 32 [=] — **2**

LINE — 5 [SHIFT] [$x^{▪}$] ($\sqrt[▪]{\square}$) 32 [)] [=] — **2**

To calculate $\sqrt{2} \times 3$ ($= 3\sqrt{2} = 4.242640687...$) to three decimal places (Fix 3)

[SHIFT] [MODE] (SETUP) [6] (Fix) [3] — MATH — [√▪] 2 [▶] [×] 3 [=] — **$3\sqrt{2}$**

[SHIFT] [=] — **4.243**

LINE — [√▪] 2 [)] [×] 3 [=] — **4.243**

---

8 To convert rectangular coordinates ($\sqrt{2}$, $\sqrt{2}$) to polar coordinates

Deg

MATH — [SHIFT] [+] (Pol) [√▪] 2 [▶] [SHIFT] [)] (,) [√▪] 2 [▶] [)] [=] — **$r=2,\theta=45$**

LINE — [SHIFT] [+] (Pol) [√▪] 2 [)] [SHIFT] [)] (,) [√▪] 2 [)] [)] [=] — **r= 2**

θ= 45

To convert polar coordinates ($\sqrt{2}$, 45°) to rectangular coordinates

Deg

MATH [SHIFT] [−] (Rec) [√■] 2 [▶] [SHIFT] [)] (,) 45 [)] [=] **X=1, Y=1**

9 (5 + 3) ! = 40320 [(] 5 [+] 3 [)] [SHIFT] [x^{-1}] ($x!$) [=] **40320**

10 |2 − 7| × 2 = 10

MATH [Abs] 2 [−] 7 [▶] [×] 2 [=] **10**

LINE [Abs] 2 [−] 7 [)] [×] 2 [=] **10**

11 To obtain three random three-digit integers

1000 [SHIFT] [•] (Ran#) [=] **459**

[=] **48**

[=] **117**

(Results shown here are for illustrative purposes only. Actual results will differ.)

12 To generate random integers in the range of 1 to 6

[ALPHA] [•] (RanInt) 1 [SHIFT] [)] (,) 6 [)] [=] **2**

[=] **6**

[=] **1**

(Results shown here are for illustrative purposes only. Actual results will differ.)

13 To determine the number of permutations and combinations possible when selecting four people from a group of 10

Permutations: 10 [SHIFT] [×] (nPr) 4 [=] **5040**

Combinations: 10 [SHIFT] [÷] (nCr) 4 [=] **210**

14 To perform the following calculations when Fix 3 is selected for the number of display digits: 10 ÷ 3 × 3 and Rnd(10 ÷ 3) × 3 LINE

[SHIFT] [MODE] (SETUP) [6] (Fix) [3] 10 [÷] 3 [×] 3 [=] **10.000**

[SHIFT] [0] (Rnd) 10 [÷] 3 [)] [×] 3 [=] **9.999**

Statistical Calculations (STAT)

To start a statistical calculation, perform the key operation [MODE] [2] (STAT) to enter the STAT Mode and then use the screen that appears to select the type of calculation you want to perform.

To select this type of statistical calculation: (Regression formula shown in parentheses)	**Press this key:**
Single-variable (X)	[1] (1-VAR)
Paired-variable (X, Y), linear regression (y = A + Bx)	[2] (A+BX)
Paired-variable (X, Y), quadratic regression (y = A + Bx + Cx^2)	[3] (_+CX^2)
Paired-variable (X, Y), logarithmic regression (y = A + Bln$x$)	[4] (ln X)

Paired-variable (X, Y), e exponential regression ($y = Ae^{Bx}$)	[5] (e^X)
Paired-variable (X, Y), ab exponential regression ($y = AB^{x}$)	[6] (A•B^X)
Paired-variable (X, Y), power regression ($y = Ax^{B}$)	[7] (A•X^B)
Paired-variable (X, Y), inverse regression ($y = A + B/x$)	[8] (1/X)

Pressing any of the above keys ([1] to [8]) displays the Stat Editor.

Note: When you want to change the calculation type after entering the STAT Mode, perform the key operation [SHIFT] [1] (STAT) [1] (Type) to display the calculation type selection screen.

Inputting Data

Use the Stat Editor to input data. Perform the following key operation to display the Stat Editor: [SHIFT] [1] (STAT) [2] (Data).

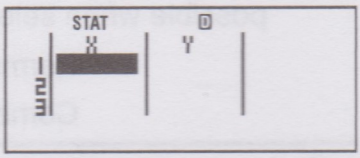
The Stat Editor provides 80 rows for data input when there is an X column only, 40 rows when there are X and FREQ columns or X and Y columns, or 26 rows when there are X, Y, and FREQ columns.

Note: Use the FREQ (frequency) column to input the quantity (frequency) of identical data items. Display of the FREQ column can be turned on (displayed) or off (not displayed) using the Stat Format setting on the setup menu.

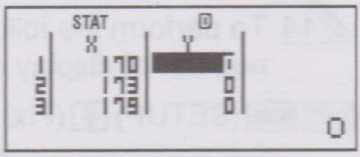
---

1 To select linear regression and input the following data:
(170, 66), (173, 68), (179, 75)

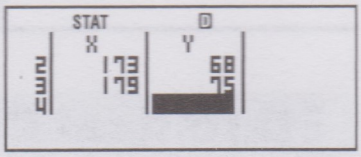
[MODE] [2] (STAT) [2] (A+BX)



170 [=] 173 [=] 179 [=] [▼] [▶]



66 [=] 68 [=] 75 [=]



Important: • All data currently input in the Stat Editor is deleted whenever you exit the STAT Mode, switch between the single-variable and a paired-variable statistical calculation type, or change the Stat Format setting on the setup menu. • The following operations are not supported by the Stat Editor: [M+], [SHIFT] [M+] (M–), [SHIFT] [RCL] (STO). Pol, Rec, and multi-statements also cannot be input with the Stat Editor.

To change the data in a cell: In the Stat Editor, move the cursor to the cell that contains the data you want to change, input the new data, and then press [=].

To delete a line: In the Stat Editor, move the cursor to the line that you want to delete and then press [DEL].

To insert a line: In the Stat Editor, move the cursor to the location where you want to insert the line and then perform the following key operation: [SHIFT] [1] (STAT) [3] (Edit) [1] (Ins).

To delete all Stat Editor contents: In the Stat Editor, perform the following key operation: [SHIFT] [1] (STAT) [3] (Edit) [2] (Del-A).

Obtaining Statistical Values from Input Data

To obtain statistical values, press [AC] while in the Stat Editor and then recall the statistical variable (σx, Σx^2, etc.) you want. Supported statistical variables and the keys you should press to recall them are shown below. For single-variable statistical calculations, the variables marked with an asterisk (*) are available.

Sum: Σx^{2*}, Σx^{*}, Σy^2, Σy, Σxy, Σx^3, $\Sigma x^2 y$, Σx^4
[SHIFT] [1] (STAT) [3] (Sum) [1] to [8]

Number of Items: n^*, **Mean:** $\bar{x}^*$, $\bar{y}$, **Population Standard Deviation:** σx^*, σy, **Sample Standard Deviation:** sx^*, sy
[SHIFT] [1] (STAT) [4] (Var) [1] to [7]

Minimum Value: minX*, minY, **Maximum Value:** maxX*, maxY
[SHIFT] [1] (STAT) [5] (MinMax) [1] to [2]
(When the single-variable statistical calculation is selected)
[SHIFT] [1] (STAT) [6] (MinMax) [1] to [4]
(When a paired-variable statistical calculation is selected)

Regression Coefficients: A, B, **Correlation Coefficient:** r, **Estimated Values:** $\hat{x}$, $\hat{y}$
[SHIFT] [1] (STAT) [5] (Reg) [1] to [5]

Regression Coefficients for Quadratic Regression: A, B, C, **Estimated Values:** $\hat{x}_1$, $\hat{x}_2$, $\hat{y}$
[SHIFT] [1] (STAT) [5] (Reg) [1] to [6]

- See the table at the beginning of this section of the manual for the regression formulas.
- $\hat{x}$, $\hat{x}_1$, $\hat{x}_2$ and $\hat{y}$ are not variables. They are commands of the type that take an argument immediately before them. See "Calculating Estimated Values" for more information.

---

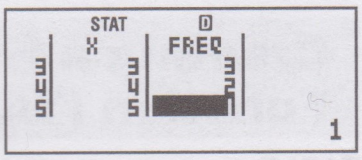
2 To input the single-variable data x = {1, 2, 2, 3, 3, 3, 4, 4, 5}, using the FREQ column to specify the number of repeats for each items ({xn; freq$n$} = {1;1, 2;2, 3;3, 4;2, 5;1}), and calculate the mean and population standard deviation.

[SHIFT] [MODE] (SETUP) [▼] [3] (STAT) [1] (ON)

[MODE] [2] (STAT) [1] (1-VAR)

1 [=] 2 [=] 3 [=] 4 [=] 5 [=] [▼] [▶]

1 [=] 2 [=] 3 [=] 2 [=]



[AC] [SHIFT] [1] (STAT) [4] (Var) [2] ($\bar{x}$) [=]

3

[AC] [SHIFT] [1] (STAT) [4] (Var) [3] (σx) [=]

1.154700538

Results: Mean: 3 Population Standard Deviation: 1.154700538

---

3 To calculate the linear regression and logarithmic regression correlation coefficients for the following paired-variable data and determine the regression formula for the strongest correlation: (x, y) = (20, 3150), (110, 7310), (200, 8800), (290, 9310). Specify Fix 3 (three decimal places) for results.

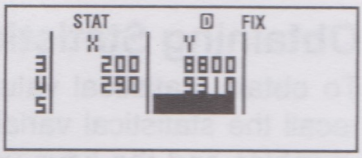
[SHIFT] [MODE] (SETUP) [▼] [3] (STAT) [2] (OFF)

[SHIFT] [MODE] (SETUP) [6] (Fix) [3]

[MODE] [2] (STAT) [2] (A+BX)

20 [=] 110 [=] 200 [=] 290 [=] [▼] [▶]

3150 [=] 7310 [=] 8800 [=] 9310 [=]



[AC] [SHIFT] [1] (STAT) [5] (Reg) [3] (r) [=] 0.923

[AC] [SHIFT] [1] (STAT) [1] (Type) [4] (ln X)

[AC] [SHIFT] [1] (STAT) [5] (Reg) [3] (r) [=] 0.998

[AC] [SHIFT] [1] (STAT) [5] (Reg) [1] (A) [=] -3857.984

[AC] [SHIFT] [1] (STAT) [5] (Reg) [2] (B) [=] 2357.532

Results: Linear Regression Correlation Coefficient: 0.923
Logarithmic Regression Correlation Coefficient: 0.998
Logarithmic Regression Formula: $y = -3857.984 + 2357.532\ln x$

Calculating Estimated Values

Based on the regression formula obtained by paired-variable statistical calculation, the estimated value of y can be calculated for a given x-value. The corresponding x-value (two values, x_1 and x_2, in the case of quadratic regression) also can be calculated for a value of y in the regression formula.

4 To determine the estimate value for y when $x = 160$ in the regression formula produced by logarithmic regression of the data in 3. Specify Fix 3 for the result. (Perform the following operation after completing the operations in 3.)

[AC] 160 [SHIFT] [1] (STAT) [5] (Reg) [5] ($\hat{y}$) [=] 8106.898

Result: 8106.898

Important: Regression coefficient, correlation coefficient, and estimated value calculations can take considerable time when there are a large number of data items.

Creating a Number Table from a Function (TABLE)

TABLE generates a number table for x and $f(x)$ using an input $f(x)$ function. Perform the following steps to generate a number table.

1. Press [MODE] [3] (TABLE) to enter the TABLE Mode.
2. Input a function in the format $f(x)$, using the X variable.
   - Be sure to input the X variable ([ALPHA] [)] (X)) when generating a number table. Any variable other than X is handled as a constant.
   - Pol and Rec cannot be input in the function.

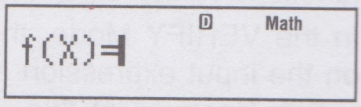
3. In response to the prompts that appear, input the values you want to use, pressing [=] after each one.

For this prompt:	Input this:
Start?	Input the lower limit of X (Default = 1).
End?	Input the upper limit of X (Default = 5). **Note:** Make sure that the End value is always greater than the Start value.
Step?	Input the increment step (Default = 1). **Note:** The Step specifies by how much the Start value should be sequentially incremented as the number table is generated. If you specify Start = 1 and Step = 1, X sequentially will be assigned the values 1, 2, 3, 4, and so on to generate the number table until the End value is reached.

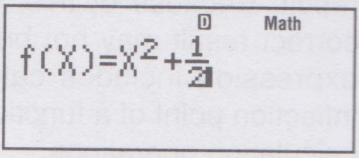
- Inputting the Step value and pressing [=] generates and displays the number table in accordance with the parameters you specified.
- Pressing [AC] while the number table screen is displayed will return to the function input screen in step 2.

To generate a number table for the function $f(x) = x^2 + \frac{1}{2}$ for the range $-1 \leqq x \leqq 1$, incremented in steps of 0.5 **MATH**

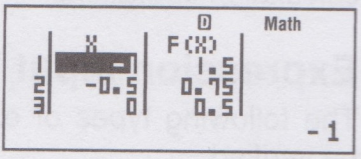
[MODE] [3] (TABLE)



[ALPHA] [)] (X) [x^2] [+] 1 [▤] 2



[=] [(−)] 1 [=] 1 [=] 0.5 [=]



Note: • You can use the number table screen for viewing values only. Table contents cannot be edited. • The number table generation operation causes the contents of variable X to be changed.

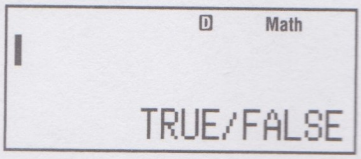
Important: The function you input for number table generation is deleted whenever you display the setup menu in the TABLE Mode and switch between Natural Display and Linear Display.

Using VERIFY (VERIF)

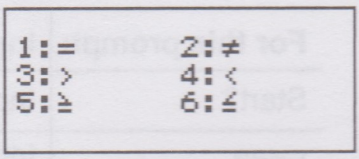
VERIFY is a function you can use to verify whether an input equality or inequality is true (indicated by TRUE) or false (indicated by FALSE). The following shows the general procedure for using VERIFY.

To verify whether $4\sqrt{9} = 12$ is true **MATH**

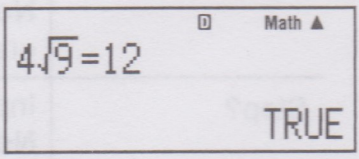
1. Press [MODE] [4] (VERIF) to enter the VERIFY Mode.



2. Input $4\sqrt{9} = 12$.
   4 √ 9 ▶ SHIFT 2 (VERIFY) 1 (=)12
   - You can select the equality symbol or inequality symbol from the menu that appears when you press SHIFT 2 (VERIFY).



3. To verify, press =.



You can input the following expressions for verification in the VERIFY Mode.

- Equalities or inequalities that include one relational operator $4 = \sqrt{16}$, $4 \neq 3$, $\pi > 3$, $1 + 2 \leqq 5$, $(3 \times 6) < (2 + 6) \times 2$, etc.
- Equalities or inequalities that include multiple relational operators $1 \leqq 1 < 1 + 1$, $3 < \pi < 4$, $2^2 = 2 + 2 = 4$, $2 + 2 = 4 < 6$, $2 + 3 = 5 \neq 2 + 5 = 8$, etc.

Note: • The verification result will cause 1 to be assigned to Ans memory when TRUE and 0 when FALSE. • The input expression can be a total of 99 bytes, including the left side, right side, and relational operators. • Any variable (A, B, C, D, E, F, X, Y, M) input into an expression is treated as a value, using the value currently assigned to the variable. • Pol and Rec functions cannot be used in an expression.

In the VERIFY Mode, the calculator performs a mathematical operation on the input expression and then displays TRUE or FALSE based on the result. Because of this, calculation error can occur or a mathematically correct result may not be able to be displayed when the input calculation expression includes calculation that approaches the singular point or inflection point of a function, or when the input expression contains multiple calculation operations.

Expression Input Precautions

The following types of expressions cause a Syntax ERROR and cannot be verified.

- An expression with nothing on the left side or right side (Example: $= 5\sqrt{7}$)
- An expression in which a relational operator is inside of a fraction or function (Example: $\frac{1 = 1}{2}$, $\cos(8 \leqq 9)$)
- An expression in which a relational operator is enclosed in parentheses (Example: $8 < (9 < 10)$)
- An expression in which multiple relational operators that are not oriented in the same direction (Example: $5 \leqq 6 \geqq 4$)
- An expression that contains two of the following operators in any combination (Example: $4 < 6 \neq 8$)
- An expression that contains consecutive relational operators (Example: $5 \geqq > 9$)

VERIFY Mode Calculation Examples

To verify log2 < log3 < log4

MODE 4 (VERIF)

log 2) SHIFT 2 (VERIFY) 4 (<)

log 3) SHIFT 2 (VERIFY) 4 (<)

log 4) =

TRUE

To verify $0 < \left(\frac{8}{9}\right)^3 - \left(\frac{8}{9}\right)^2$ MATH

MODE 4 (VERIF)

0 SHIFT 2 (VERIFY) 4 (<)

8 ab/c 9 ▶ x^3 − 8 ab/c 9 ▶ x^2 =

FALSE

To verify $5^2 = 25 = \sqrt{625}$ MATH

MODE 4 (VERIF)

5 x^2 SHIFT 2 (VERIFY) 1 (=)

25 SHIFT 2 (VERIFY) 1 (=) $\sqrt{\square}$ 625 =

TRUE

Calculation Ranges, Number of Digits, and Precision

The calculation range, number of digits used for internal calculation, and calculation precision depend on the type of calculation you are performing.

Calculation Range and Precision

Calculation Range	$\pm 1 \times 10^{-99}$ to $\pm 9.999999999 \times 10^{99}$ or 0
Number of Digits for Internal Calculation	15 digits
Precision	In general, ±1 at the 10th digit for a single calculation. Precision for exponential display is ±1 at the least significant digit. Errors are cumulative in the case of consecutive calculations.

Function Calculation Input Ranges and Precision

Functions		Input Range
sin$x$	DEG	$0 \leqq \lvert x \rvert < 9 \times 10^9$
	RAD	$0 \leqq \lvert x \rvert < 157079632.7$
	GRA	$0 \leqq \lvert x \rvert < 1 \times 10^{10}$
cos$x$	DEG	$0 \leqq \lvert x \rvert < 9 \times 10^9$
	RAD	$0 \leqq \lvert x \rvert < 157079632.7$
	GRA	$0 \leqq \lvert x \rvert < 1 \times 10^{10}$

$\tan x$	DEG	Same as $\sin x$, except when $\|x\| = (2n-1) \times 90$.
	RAD	Same as $\sin x$, except when $\|x\| = (2n-1) \times \pi/2$.
	GRA	Same as $\sin x$, except when $\|x\| = (2n-1) \times 100$.
$\sin^{-1} x$	$0 \leqq \|x\| \leqq 1$	
$\cos^{-1} x$		
$\tan^{-1} x$	$0 \leqq \|x\| \leqq 9.999999999 \times 10^{99}$	
$\sinh x$	$0 \leqq \|x\| \leqq 230.2585092$	
$\cosh x$		
$\sinh^{-1} x$	$0 \leqq \|x\| \leqq 4.999999999 \times 10^{99}$	
$\cosh^{-1} x$	$1 \leqq x \leqq 4.999999999 \times 10^{99}$	
$\tanh x$	$0 \leqq \|x\| \leqq 9.999999999 \times 10^{99}$	
$\tanh^{-1} x$	$0 \leqq \|x\| \leqq 9.999999999 \times 10^{-1}$	
$\log x/\ln x$	$0 < x \leqq 9.999999999 \times 10^{99}$	
10^x	$-9.999999999 \times 10^{99} \leqq x \leqq 99.99999999$	
e^x	$-9.999999999 \times 10^{99} \leqq x \leqq 230.2585092$	
$\sqrt{x}$	$0 \leqq x < 1 \times 10^{100}$	
x^2	$\|x\| < 1 \times 10^{50}$	
x^{-1}	$\|x\| < 1 \times 10^{100}$; $x \neq 0$	
$\sqrt[3]{x}$	$\|x\| < 1 \times 10^{100}$	
$x!$	$0 \leqq x \leqq 69$ (x is an integer)	
$n\mathrm{P}r$	$0 \leqq n < 1 \times 10^{10}$, $0 \leqq r \leqq n$ (n, r are integers) $1 \leqq \{n!/(n-r)!\} < 1 \times 10^{100}$	
$n\mathrm{C}r$	$0 \leqq n < 1 \times 10^{10}$, $0 \leqq r \leqq n$ (n, r are integers) $1 \leqq n!/r! < 1 \times 10^{100}$ or $1 \leqq n!/(n-r)! < 1 \times 10^{100}$	
$\mathrm{Pol}(x, y)$	$\|x\|, \|y\| \leqq 9.999999999 \times 10^{99}$ $\sqrt{x^2+y^2} \leqq 9.999999999 \times 10^{99}$	
$\mathrm{Rec}(r, \theta)$	$0 \leqq r \leqq 9.999999999 \times 10^{99}$ θ: Same as $\sin x$	
$^\circ\,' \,''$	$\|a\|, b, c < 1 \times 10^{100}$; $0 \leqq b, c$ The display seconds value is subject to an error of ±1 at the second decimal place.	
$\overleftarrow{^\circ\,' \,''}$	$\|x\| < 1 \times 10^{100}$ Decimal ↔ Sexagesimal Conversions $0°0'0'' \leqq \|x\| \leqq 9999999°59'59''$	
x^y	$x > 0$: $-1 \times 10^{100} < y\log x < 100$ $x = 0$: $y > 0$ $x < 0$: $y = n, \frac{m}{2n+1}$ (m, n are integers) However: $-1 \times 10^{100} < y\log \|x\| < 100$	

$\sqrt[x]{y}$	$y > 0$: $x \neq 0$, $-1 \times 10^{100} < 1/x \log y < 100$ $y = 0$: $x > 0$ $y < 0$: $x = 2n+1$, $\frac{2n+1}{m}$ ($m \neq 0$; m, n are integers) However: $-1 \times 10^{100} < 1/x \log \lvert y \rvert < 100$
$a\,^b/_c$	Total of integer, numerator, and denominator must be 10 digits or less (including division marks).
RanInt#(a, b)	$a < b$; $\lvert a \rvert$, $\lvert b \rvert < 1 \times 10^{10}$; $b - a < 1 \times 10^{10}$

- Precision is basically the same as that described under "Calculation Range and Precision", above.
- x^y, $\sqrt[x]{y}$, $\sqrt[3]{\ }$, $x!$, nPr, nCr type functions require consecutive internal calculation, which can cause accumulation of errors that occur with each calculation.
- Error is cumulative and tends to be large in the vicinity of a function's singular point and inflection point.
- The range for calculation results that can be displayed in π form when using Natural Display is $\lvert x \rvert < 10^6$. Note, however, that internal calculation error can make it impossible to display some calculation results in π form. It also can cause calculation results that should be in decimal form to appear in π form.

Errors

The calculator will display an error message whenever an error occurs for any reason during a calculation. There are two ways to exit an error message display: Pressing ◀ or ▶ to display the location of the error, or pressing AC to clear the message and calculation.

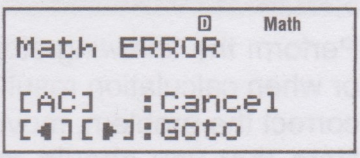
Displaying the Location of an Error

While an error message is displayed, press ◀ or ▶ to return to the calculation screen. The cursor will be positioned at the location where the error occurred, ready for input. Make the necessary corrections to the calculation and execute it again.

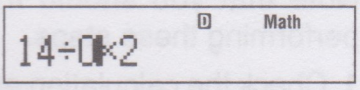
When you input 14 ÷ 0 × 2 = by mistake instead of 14 ÷ 10 × 2 =

MATH

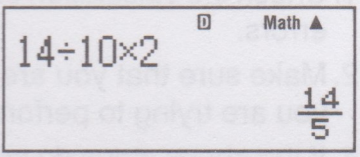
14 ÷ 0 × 2 =



▶ (or ◀)



◀ 1 =



Clearing the Error Message

While an error message is displayed, press AC to return to the calculation screen. Note that this also clears the calculation that contained the error.

B

Error Messages

Math ERROR

Cause: • The intermediate or final result of the calculation you are performing exceeds the allowable calculation range. • Your input exceeds the allowable input range (particularly when using functions). • The calculation you are performing contains an illegal mathematical operation (such as division by zero).

Action: • Check the input values, reduce the number of digits, and try again. • When using independent memory or a variable as the argument of a function, make sure that the memory or variable value is within the allowable range for the function.

Stack ERROR

Cause: The calculation you are performing has caused the capacity of the numeric stack or the command stack to be exceeded.

Action: • Simplify the calculation expression so it does not exceed the capacity of the stack. • Try splitting the calculation into two or more parts.

Syntax ERROR

Cause: There is a problem with the format of the calculation you are performing.

Action: Make necessary corrections.

Insufficient MEM Error

Cause: The configuration of TABLE Mode parameters caused more than 30 X-values to be generated for a table.

Action: Narrow the table calculation range by changing the Start, End, and Step values, and try again.

Argument ERROR

Cause: A non-integer argument was input for the random number function (RanInt#).

Action: Input only integers for the argument.

Before Assuming Malfunction of the Calculator...

Perform the following steps whenever an error occurs during a calculation or when calculation results are not what you expected. If one step does not correct the problem, move on to the next step.

Note that you should make separate copies of important data before performing these steps.

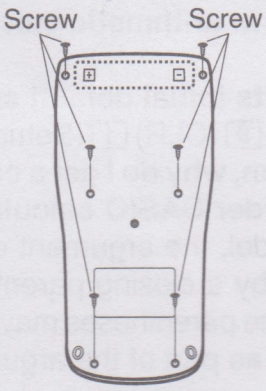
1. Check the calculation expression to make sure that it does not contain any errors.
2. Make sure that you are using the correct mode for the type of calculation you are trying to perform.
3. If the above steps do not correct your problem, press the [ON] key. This will cause the calculator to perform a routine that checks whether calculation functions are operating correctly. If the calculator discovers any abnormality, it automatically initializes the calculation mode and clears memory contents. For details about initialized settings, see "Configuring the Calculator Setup".
4. Initialize all modes and settings by performing the following operation: [SHIFT] [9] (CLR) [1] (Setup) [=] (Yes).

Replacing the Battery

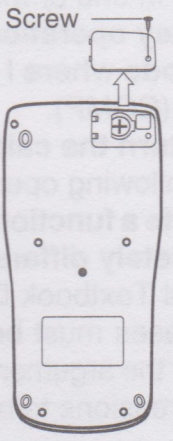
A low battery is indicated by a dim display, even if contrast is adjusted, or by failure of figures to appear on the display immediately after you turn on the calculator. If this happens, replace the battery with a new one.

Important: Removing the battery will cause all of the calculator's memory contents to be deleted.

1. Press [SHIFT] [AC] (OFF) to turn off the calculator.
2. Remove the cover as shown in the illustration and replace the battery, taking care that its plus (+) and minus (–) ends are facing correctly.
3. Replace the cover.
4. Initialize the calculator: [ON] [SHIFT] [9] (CLR) [3] (All) [=] (Yes)
   • Do not skip the above step!



fx-83GT PLUS



fx-85GT PLUS

Specifications

Power Requirements:
fx-83GT PLUS: AAA-size battery R03 (UM-4) × 1
fx-85GT PLUS: Built-in solar cell; button battery LR44 (GPA76) × 1

Approximate Battery Life:
fx-83GT PLUS: 17,000 hours (continuous display of flashing cursor)
fx-85GT PLUS: 3 years (based on one hour of operation per day)

Power Consumption: 0.0002 W (fx-83GT PLUS)

Operating Temperature: 0°C to 40°C (32°F to 104°F)

Dimensions:
fx-83GT PLUS: 13.8 (H) × 80 (W) × 162 (D) mm
$\frac{1}{2}$″ (H) × $3\frac{1}{8}$″ (W) × $6\frac{3}{8}$″ (D)
fx-85GT PLUS: 11.1 (H) × 80 (W) × 162 (D) mm
$\frac{3}{8}$″ (H) × $3\frac{1}{8}$″ (W) × $6\frac{3}{8}$″ (D)

Approximate Weight:
fx-83GT PLUS: 100 g (3.5 oz) including the battery
fx-85GT PLUS: 95 g (3.4 oz) including the battery

Frequently Asked Questions

■ **How can I perform input and display results the same way I did on a model that does not have Natural Textbook Display?**
Perform the following key operation: [SHIFT] [MODE] (SETUP) [2] (LineIO). See "Configuring the Calculator Setup" on page E-5 for more information.

■ **How can I change a fraction form result to decimal form?**
How can I change a fraction form result produced by a division operation to decimal form?
See "Toggling Calculation Results" on page E-11 for the procedure.

■ **What is the difference between Ans memory, independent memory, and variable memory?**
Each of these types of memory acts like "containers" for temporary storage of a single value.
Ans Memory: Stores the result of the last calculation performed. Use this memory to carry the result of one calculation on to the next.
Independent Memory: Use this memory to totalize the results of multiple calculations.
Variables: This memory is helpful when you need to uses the same value multiple times in one or more calculations.

■ **What is the key operation to take me from the STAT Mode or TABLE Mode to a mode where I can perform arithmetic calculations?**
Press [MODE] [1] (COMP).

■ **How can I return the calculator to its initial default settings?**
Perform the following operation: [SHIFT] [9] (CLR) [1] (Setup) [=] (Yes)

■ **When I execute a function calculation, why do I get a calculation result that is completely different from older CASIO calculator models?**
With a Natural Textbook Display model, the argument of a function that uses parentheses must be followed by a closing parenthesis. Failing to press [)] after the argument to close the parentheses may cause unwanted values or expressions to be included as part of the argument.

Example: (sin 30) + 15 **Deg**

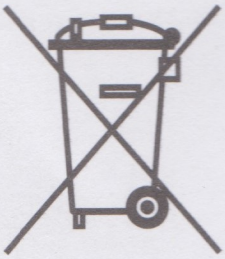
Older (S-VPAM) Model: [sin] 30 [+] 15 [=] **15.5**

Natural Textbook Display Model: **LINE** [sin] 30 [)] [+] 15 [=] **15.5**

Failure to press [)] here as shown below will result in calculation of sin 45.

[sin] 30 [+] 15 [=] **0.7071067812**

Disposal of Waste Batteries
(Applicable in the European Union only)

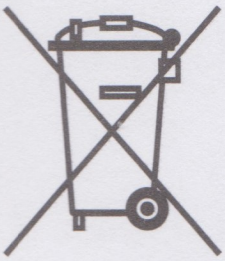


The symbol (crossed out wheeled-bin) on your battery indicates that the battery shall **not** be disposed with other unsorted waste, but shall be collected separately and handed over to your local community waste collection point or other available collection points for the recycling, at the end of its use.
If a chemical symbol is printed under the symbol it indicates that chemical substances (Hg = mercury, Cd = cadmium or Pb = lead) are contained in the battery.

Inappropriate waste handling could possibly have a negative effect on the environment and human health due to potential hazardous substances. With your cooperation in the correct disposal of this battery, you contribute to reuse, recycle and recover the batteries and our environment will be protected.

For more information, please contact the Government Waste-Disposal department in your country or the shop where the battery was purchased.

Disposal of Waste Electrical & Electronic Equipment of products for Household use
(Applicable in the European Union only)



The symbol (crossed out wheeled-bin) on your product indicates that the product shall not be mixed or disposed with your household waste, at their end of use.

This product shall be handed over to your local community waste collection point for the recycling of the product.

For more information, please contact your Government Waste-Disposal department in your country.
Inappropriate waste handling could possibly have a negative effect on the environment and human health due to potential hazardous substances. With your cooperation in the correct disposal of this product, you contribute to reuse, recycle and recover the product and our environment will be protected.

Disposal of Waste Electrical & Electronic Equipment of products for business use
(Applicable in the European Union only)

For further information regarding the disposal of products for business purposes, please contact your dealer or distributor in your country. This product shall not be mixed or disposed with commercial waste.

CE

Manufacturer:
CASIO COMPUTER CO., LTD.
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